ENABLING TECHNOLOGIES & INNOVATION CONSORTIUM

2021 Newsletter

Georgia Tech | ETI

WELCOME TO UNIVERSITY PROGRAM REVIEW 2021

September 8-10, 2021

ETI 101: FUNDAMENTALS OF NUCLEAR SCIENCE AND ENGINEERING FOR NONPROLIFERATION

Spring 2021

ETI 101, Fundamentals of Nuclear Science and Engineering for Nonproliferation, was offered during the spring 2021 semester as a pilot offering. It began on January 12 with two weekly lectures and concluded on May 6. The course objective is to engage the ETI academic community and the interested community at large at participating universities and national labs and to introduce the foundations of nuclear science and engineering as they apply to nonproliferation problems. This is an online course hosted by university members of the consortium. ETI 101 delivered introductory lectures on

- nuclear science of radiation interactions (*8 lectures, January 12–February 4*),
- nuclear engineering of reactors and systems (*8 lectures, February 9–March 4*),
- nuclear fuel cycle and waste management (*8 lectures, March 9–April 1*),
- overview of nuclear security and nonproliferation (*10 lectures, April 6–May 6*).

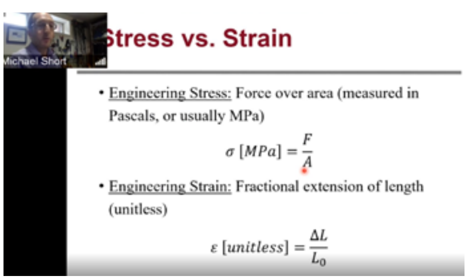
Over 15 experts from academia and national laboratories contributed lecture materials and resources to the course.

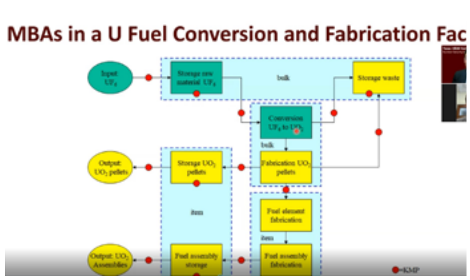
The lectures were well attended, averaging 10–20 attendees per lecture. Lectures are delivered in a synchronous format with asynchronous access provided via posted materials and recordings. All course materials, presentations, and video recordings contributed by faculty and national lab experts have been cleared for broad distribution and are posted on the ETI 101 website.

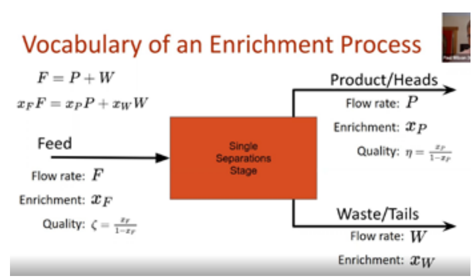
From participants:

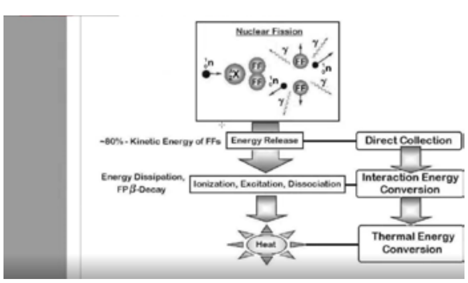
- I really liked this module! I enjoyed the content, found it to be very informative and engaging.
- Great work by all of the presenters.
- I thought that getting some background in nuclear science would be invaluable, and I must say this course certainly helped me flesh out my knowledge in this tangential field.
- The course was well laid out with four modules starting with the fundamentals of nuclear power and physics. Coming from an electrical engineering background, the introductory modules were especially useful for the understanding of nuclear physics and reactors.
- The course logistics and delivery method were well-ordered with helpful live sessions.

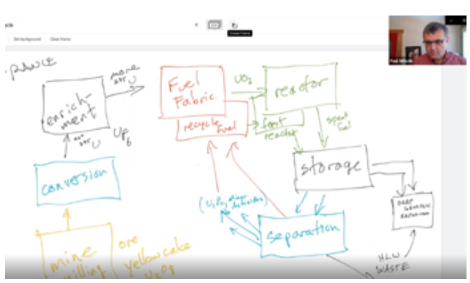
Plans are in the works to deliver ETI 101 again in Spring 2022

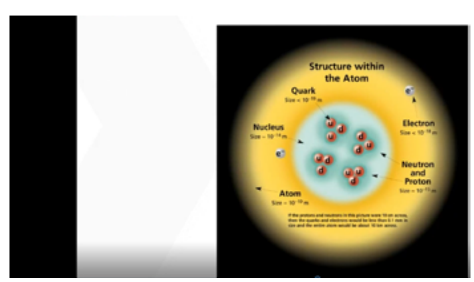


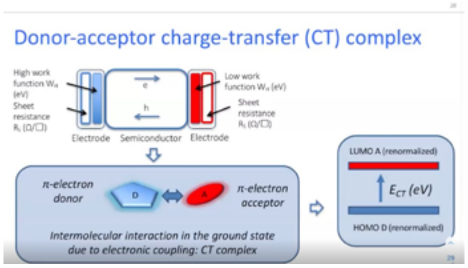


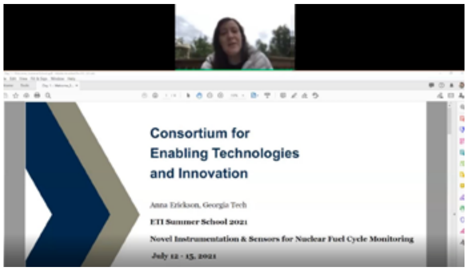


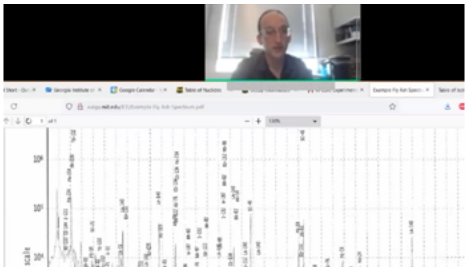












ETI SUMMER SCHOOL 2021

Novel Instrumentation and Sensors for Nuclear Fuel Cycle Monitoring

The ETI annual summer school series continued in 2021 with our second summer school. Building on the tremendous success of our first summer school, which was conducted virtually due to the global pandemic constraints, we offered the virtual summer school 2021. This year the focus was on novel instrumentation and sensors for nuclear fuel cycle monitoring. We started with a basic knowledge of radiation detection, transitioned to their safeguard applications in national laboratory settings, and finished with various cutting-edge topics shared by ETI faculty. Over the four days, July 12–July 15, experts from the national laboratories and academia delivered lectures and hands-on demonstrations:

Day 1 – Basic radiation detection. The first day of the summer school provided an introduction to the basics of radiation detection. The topic was broken into three sections: **(1)** gas detectors, **(2)** semiconductor detectors, and **(3)** scintillator detectors. Each section included a lecture followed by a demonstration. Lectures and demonstrations were delivered by Steven Biegalski and Anna Erickson of Georgia Institute of Technology. Resources from the laboratories at Georgia Tech were used to provide participants with immersive demonstrations and hands-on exercises. Notably, materials from ETI 101, which concluded in spring 2021, were used to support the lectures.

Day 2 – Safeguards and security measurements. The second day focused on the key areas of safeguards and security measurements. The subject matter was covered through six lectures with corresponding demonstrations and interactive exercises: **(1)** high-level review of NDA role in safeguards, **(2)** search/locate/gross counting applications, **(3)** identification and gamma spectroscopy, **(4)** enrichment measurements, **(5)** gamma counting, and **(6)** neutron counting. The excellent ORNL team of experts led by Angela Lousteau, including Robert Bean, Greg Nutter, Susan Smith, and Ram Venkataraman, delivered lectures and demonstration. Extensive resources from and capabilities of the ORNL safeguards laboratory supported hands-on demonstrations and exercises.

Day 3 – Safeguards measurements, plastic scintillators and GaN devices, reactor-based isotope forensics. Discussion of safeguards measurements continued in the morning of the third day, and then the topic transitioned to ETI-focused topics such as plastic scintillators and GaN devices, and ended with an interesting hands-on practice on the reactor-based isotope forensics. The material was presented via four dedicated lectures with complimentary demonstrations: **(1)** active neutron interrogation measurements for material characterization, **(2)** plastic scintillators, **(3)** wide and ultra-wide bandgap semiconductor devices, and **(4)** reactor-based isotope forensics. Experts from Lawrence Livermore National Laboratory (Chris Brand, Vladimir Mozin, Phil Kerr, Mark Mitchell, Vincenzo Lordi), Colorado School of Mines (Alan Sellinger), The Ohio State University (Siddharth Rajan), and Massachusetts Institute of Technology (Michael Short) dedicated their time and resources to the successful day of engaging lectures and demonstrations.

ETI Summer School 2021, continued

Day 4 – Biota, advanced materials and photosensors. The final day of the summer school covered a number of important topics in biota areas in the morning, including radionuclide biomonitoring in the environment, environmental radiation detection, hyperspectral remote sensing of plants, manufacturing of radiation detectors using advanced materials, and fundamentals of organic photodiodes and their future use for the detection of ionizing radiation. Martine Duff and Charles Turick of Savannah River National Laboratory and Phil Townsend of University of Wisconsin delivered lectures using resources of their respective laboratories and research groups. The afternoon session and hands-on demonstrations continued with ETI topics at introductory level: detector manufacturing using advanced materials, and photosensors. These lectures were provided by Bernard Kippelen of Georgia Institute of Technology, Jinsong Huang of University of North Carolina at Chapel Hill, and Raymond Cao of The Ohio State University.

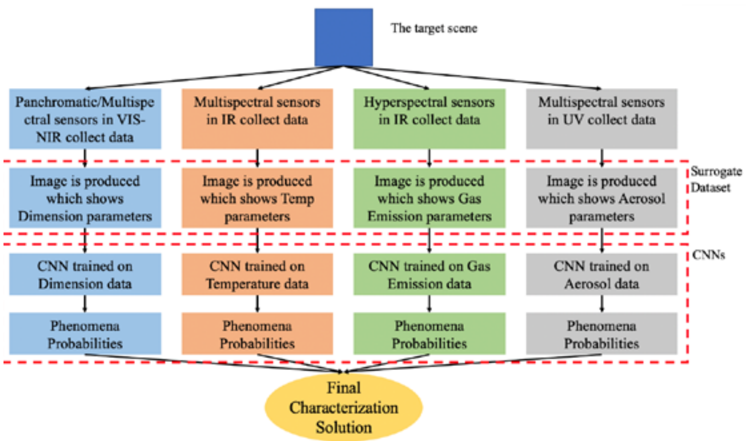
The lectures were delivered by leveraging our experiences in 2020, and we thank our speakers and contributors for significant preparation efforts, which enabled us to provide our attendees with engaging hands-on demonstrations remotely.

Our summer school was attended by 116 participants from academia and national labs. Nearly 53% of participants estimated their level as "beginner," while close to 8% assessed themselves as being at "advanced" and almost 28% assessed themselves as being at "intermediate" levels. An additional 10% of attendees were at the highest "expert" level. University participants included undergraduate, graduate M.S. and graduate Ph.D. students as well as post-doctoral researchers.

All summer school materials, presentations, and video recordings contributed by faculty and national lab experts have been cleared for broad distribution and are posted on the ETI summer school 2021 website.

From participants:

- I personally enjoyed the demonstration videos using equipment mentioned in the lectures.
- The hands-on demonstrations were very enjoyable and informative.
- Overall, really nice! Learned a lot from the different modules, whether it covered perovskites or hyperspectral imaging, it was all very valuable to see the state-of-the-art.
- Overall, it was a great experience.



1. Mario Mendoza (TAMU): *Development of a Multi-Modal Global Surveillance Methodology*

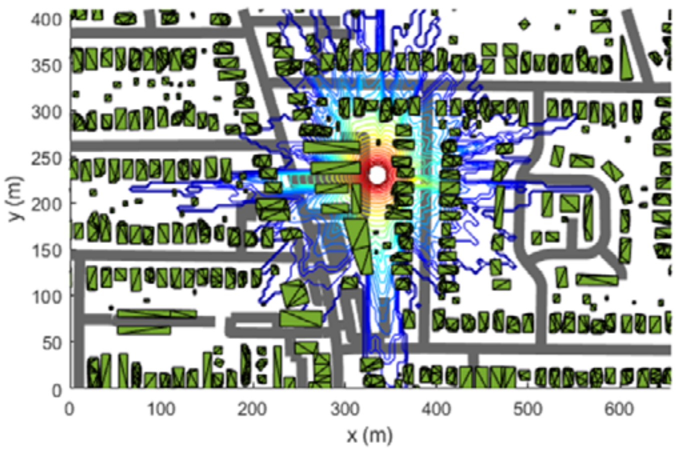
This project focused on work completed towards the development of a multi-modal global surveillance methodology using cube satellite (CubeSat) platforms and novel data analysis techniques. A CubeSat system equipped with adequate sensors and data analytics capabilities can autonomously characterize various phenomena of interest on the Earth's surface. CubeSats are advantageous over conventional satellites in certain remote monitoring applications because of their reduced construction costs (due to the availability of commercial off-the-shelf components) and are easier to launch. The CubeSat surveillance system developed in this project looked at phenomena of interest surrounding the nuclear fuel cycle in support of nuclear nonproliferation and emergency response. To observe the phenomena, a constellation of 3U and 6U CubeSats deployed from the ISS with adequate components was chosen. Four different sensor configurations were identified for remote sensing: panchromatic/multispectral in the visible and near-infrared spectrum, multispectral in infrared spectrum, hyperspectral in infrared spectrum, and multispectral in ultraviolet spectrum. While a panchromatic/multispectral sensor configuration has CubeSat flight heritage at the required spatial resolutions, the other three sensor types need future development to meet signature and system requirements. Once each sensor onboard the CubeSat system collects data on a target of interest, the onboard computers would then apply the deep learning-based characterization methodology developed in this project to identify the phenomena. Four surrogate datasets containing representative, simplified "images" were created for each sensor type to train the characterization methodology. A convolutional neural network was applied to each dataset and produced recall rates for the phenomena of 89.7%–99.3% and precision rates of 92.3%–99.9%. Recall rates refer to the ratio of phenomena correctly identified by the methodology to the actual phenomena in the image. Precision rates refer to the ratio of phenomena correctly identified by the methodology to the number of times the methodology said the phenomena were present. Each phenomenon's presence probability from each network is then combined into a final characterization solution for a target area. This project covers multiple interdisciplinary areas to develop the foundation for a CubeSat surveillance system focused on phenomena surrounding the nuclear fuel cycle.

Presentations:

- *Multi-modal Global Surveillance Science and Technology for Predictive and On-demand Characterization of Localized Processes Using Cube Satellite Platforms*, ETI 2019 Annual Workshop, November 5–6, 2019, Atlanta, Georgia
- *Multi-modal Remote Surveillance of Localized Processes Using Cube Satellite Platforms: Phenomena, Signatures, and Feasible Architectures,* ETI 2020 Annual Workshop, October 6–7, 2020, Virtual Meeting
- *Multi-modal Surveillance of Localized Processes Using Cube Satellite Platforms: Phenomena, Signatures, and Feasible Architectures,* ETI Virtual Summer Meeting for Young Researchers, July 7, 2020, Virtual Meeting
- *Multi-modal Surveillance of Localized Processes Using Cube Satellite Platforms: Phenomena, Signatures, and Feasible Architectures,* ANS Virtual Winter Meeting, November 16–19, 2020, Virtual Meeting

Publications:

- Mario Mendoza and Pavel V. Tsvetkov, "Multi-modal Surveillance of Localized Processes Using Cube Satellite Platforms: Phenomena, Signatures, and Feasible Architectures," ANS Virtual Winter Meeting Transactions, November 16, 2020.
- Mario Mendoza, Pavel V. Tsvetkov, Michael Lewis, "Multi-modal global surveillance methodology for predictive and on-demand characterization of localized processes using cube satellite platforms and deep learning techniques," *Remote Sensing Applications: Society and Environment*, Volume 22, 2021, 100518, ISSN 2352-9385, https://doi.org/10.1016/j.rsase.2021.100518.

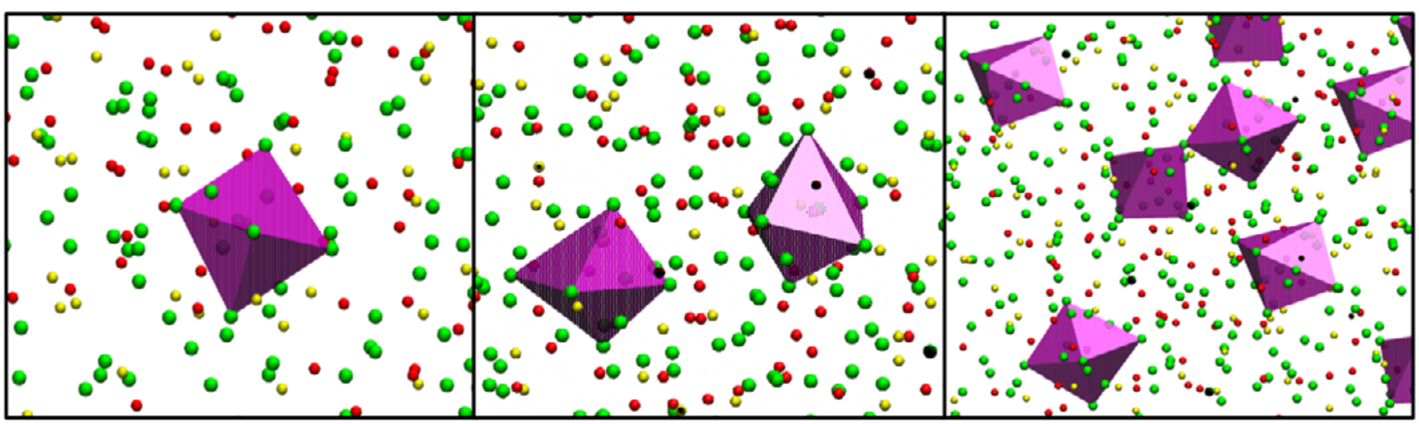


Count rates with obstacle occlusion (Green shapes are buildings. Grey lines are roads. Colored contours indicate count rate due to a point source.)

2. Sam Kemp (GT): *Heterogeneous Multi-Agent Rapid Radiological Search*

Disaster response and scenarios involving stolen nuclear material often require capabilities for rapid radiological search and mapping. Our project considers using a team of UAVs to aid an un/manned ground vehicle in a search for radioactive point sources. The UAVs will be equipped with low-cost Geiger-Müller counters and will be deployed from, land on, and recharge on the ground vehicle. The ground vehicle is a truck equipped with an array of powerful radiation sensing and imaging sensors. We are developing new path planning algorithms to allow the UAVs to provide the most useful information to the truck while considering obstacle, battery life, and sensor resolution constraints.

3. William Smith (WSU): *Predicting Raman Spectroscopy of UCl_3 in Eutectic Mixtures via Ab Initio Molecular Dynamics*



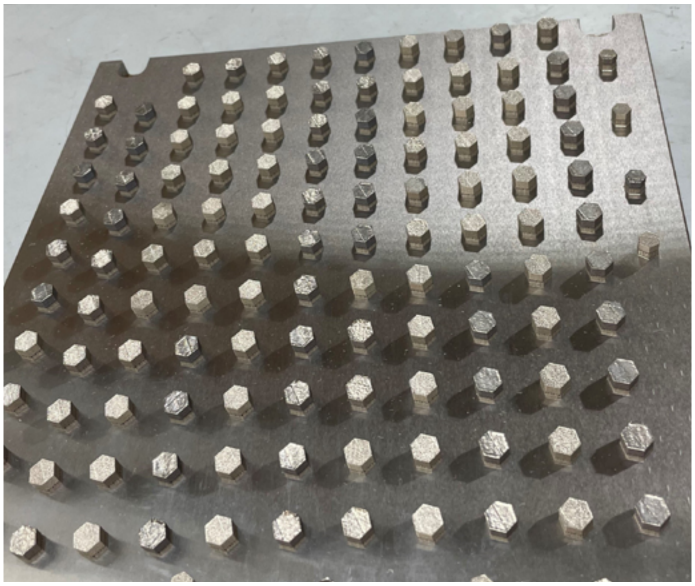
The spectroscopic characterization of lanthanide/actinide containing molten salts are limited in prior literature. *Ab initio* molecular dynamic simulations are being used to simulate molten salt reactor fuels (1.5-5 % mol UCl_3) to determine the viability of using Raman/IR spectroscopy for online monitoring. Temperature and concentration dependent studies have been conducted to determine the effect on the peak position. At the modeled concentrations, the U-Cl octahedral is still at the dilute limit, often isolated in the system and under higher concentrations (5% mol) begins to edge-share chlorides with neighboring uranium. Due to the speciation remaining nearly identical to the dilute limit, there was no reported change in the peak position for Raman/IR spectroscopy. Higher concentrations of UCl_3 are being tested to determine when oligomers begin to form and their effect on the spectroscopic signal.

Presentations:

- William Smith, Jacob Tellez, Nicole Hege, Jenifer Shafer, David Wu, and Aurora Clark. “Infrared and Raman spectroscopy of the cerium (III) and uranium (III) chloride species in eutectic mixtures from Ab initio molecular dynamics,” American Chemical Society, Atlanta, GA (August 2021)
- Jacob Tellez, William Smith, Nicole Hege, David Wu, Aurora Clark, Jenifer Shafer. “Characterization of thermophysical and structural properties of trivalent f-element chloride salts with a polarizable ion model,” American Chemical Society, Atlanta, GA (August 2021)

ETI RESEARCH SPOTLIGHTS

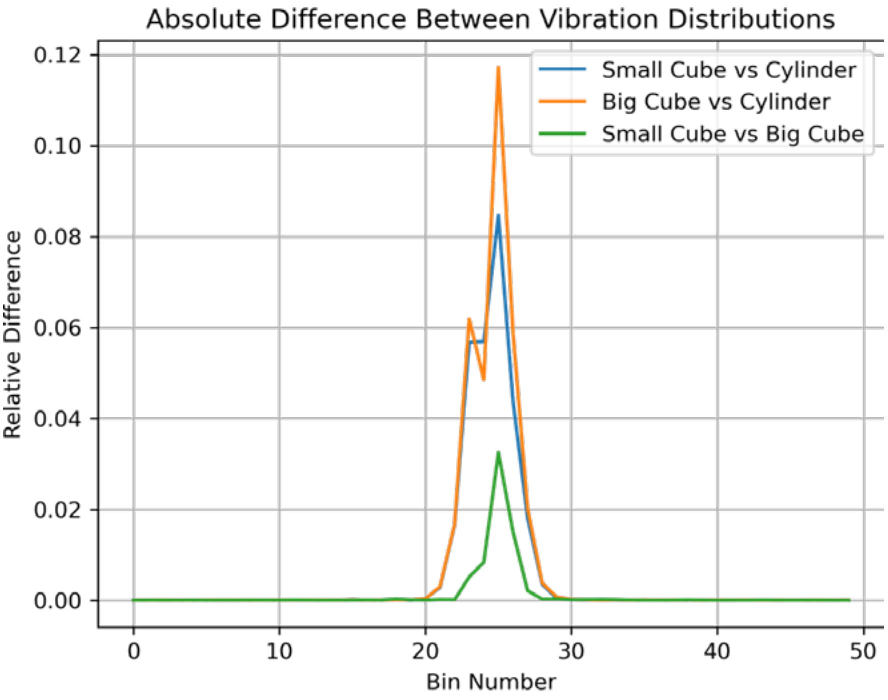
Thrust Area 2



1. Alec Mangan (UW): *Mechanical Property Signatures of High-Throughput Additively Manufactured High-Entropy Alloys*

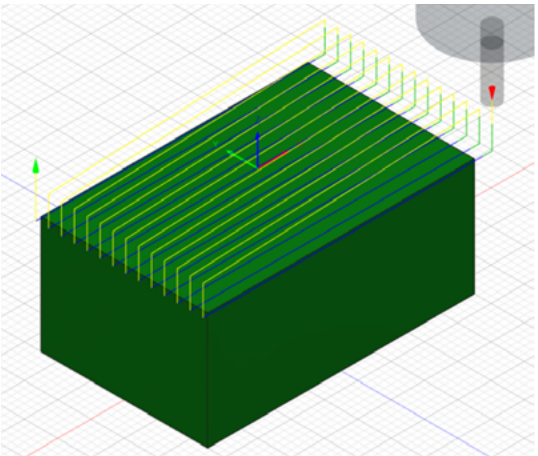
A high-throughput (HT) method to determine ideal processing conditions for FeCoNiCrMn High Entropy Alloy (HEA) has been developed. HT density and hardness measurements of hex-nut shaped samples at varying laser power and scanning speeds allowed for rapid identification of a processing window in a Select Laser Melting (SLM) additive manufacturing system. By combining the HT data with microstructure analysis on select samples, we are developing processing maps that allow manufacturers to produce SLM parts that have the properties they need.

2. Kevin Le (GT): *Evaluation of Additive Manufacturing Side Channels for Nuclear Nonproliferation Applications*



One of the technologies becoming more prominent in the nuclear industry is Additive Manufacturing (AM). The AM process gives off signatures that offer alternative means or side channels that give insight about the state of the component being manufactured. An example would be examining a thermoplastic AM machine's current draw and predicting the exact time and sequence the motors were activated. If these correlations between the side channels and the geometry being manufactured were affirmed, monitoring agencies could develop oversight methods for AM activities. Work evaluating the temperature, vibration, and current side channels has already been accomplished by utilizing an Ultimaker 2+ 3D printer. The most promising results come from the vibration side channel. Three geometries, a large cube, a small cube, and a cylinder, were used to produce 15 vibration frequency distributions where then an unsupervised machine learning (k-means clustering) algorithm was asked to group similar distributions together. The algorithm was able to showcase that there are certain vibration ranges that can be used to identify the shape and scale of the manufactured object.

3. Nicholas Greenfield (GT): *Estimating Machining Characteristics Using Side Channel Data in Advanced Manufacturing*



My project is to develop and demonstrate the capability of using data from build-in sensors on advanced machining tools to detect and identify end product characteristics within advanced manufacturing tools like the CNC milling machines. Data will be extracted and analyzed to demonstrate the feasibility of estimating basic machining parameters. This technique will be developed with physical experiments and data analysis to reliably estimate in-depth machining characteristics, cutting parameters and discover insights about the raw material being machined.

4. Scott Snarr (UT): *Multiple-Material Selective Laser Melting: Minimizing Material Contamination and Interface Scanning Strategy Development*

Advanced manufacturing methods such as multiple-material selective laser melting (SLM) facilitate new levels of design freedom for part fabrication but also potentially enable nuclear proliferation. This project aims to further develop and explore the multiple-material SLM process to better understand the threat it poses to nuclear proliferation in the future. A nozzle-based powder deposition system and novel leveling device were designed and tested to create uniform-height, contamination-free, multiple-material powder beds, as seen in the figure below. This allows for the exploration of scanning strategies for creating strong, high-quality multiple-material parts. The produced multiple-material parts will be analyzed to characterize the quality of bonding at the multiple-material interface and to quantify the bond strength. Relevant signatures of the advanced manufacturing process will then be identified and documented.

Presentations:

- Snarr, S., Najera, A., Beaman Jr., J., & Haas, D. (2021). Multiple-material powder bed fusion machine development: reducing cross-contamination between materials. Presented at the 2021 Solid Freeform Fabrication Symposium – An Additive Manufacturing Conference, Austin, TX

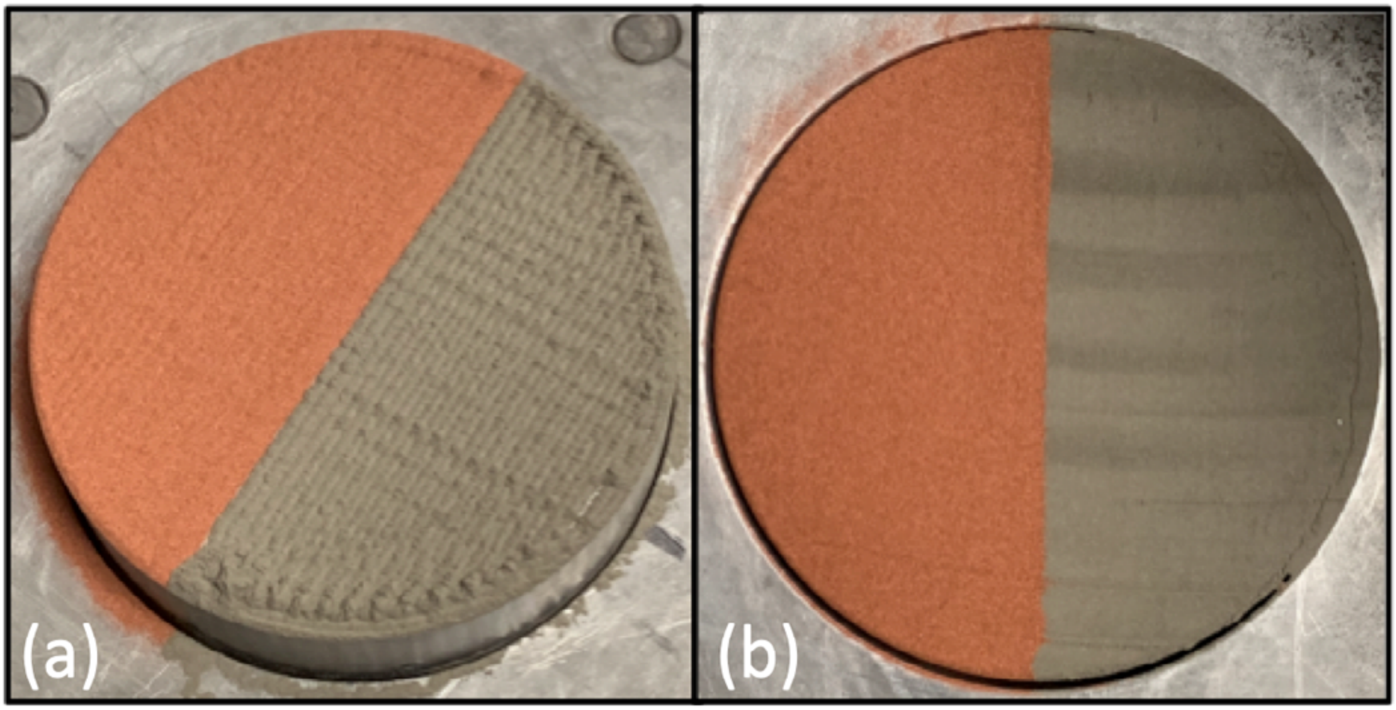
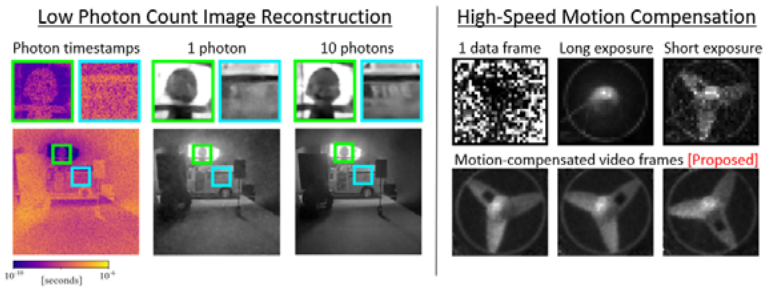


Figure 1. Multiple-material powder bed before and after leveling,
(a) Multiple-material powder bed as deposited via nozzle, (b) Leveled, contamination free multiple-material powder bed

ETI RESEARCH SPOTLIGHTS

Thrust Area 3

1. Atul Ingle (UW): *Towards Single-Photon Cameras for Low-Cost Radiation Monitoring*

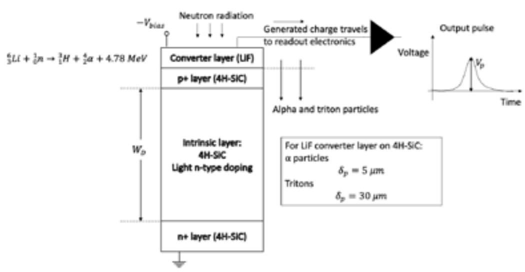


We have developed computational imaging techniques for passive imaging of scintillation photons using a rapidly emerging technology called single-photon avalanche diode (SPAD) cameras. By exploiting the high-resolution photon timestamp data captured using a SPAD camera, our computational imaging algorithms can not only capture images with extremely low photon counts but also achieve extreme dynamic range of over 10^7:1 and enable motion compensation to capture fast-moving objects. In ongoing work, we are adapting these techniques to image scintillation photons to design a high light-yield large field-of-view scintillation-based Compton camera. If successful, this work will enable portable, low-cost, high-resolution radiation imagers for large-scale deployments in various nonproliferation missions, for example, in an urban indoor environment or on mobile detection systems used at ports of entry.

Publications:

- Atul Ingle, Trevor Seets, Mauro Buttafava, Shantanu Gupta, Alberto Tosi, Mohit Gupta, and Andreas Velten. “Passive Inter-Photon Imaging.” In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition, pp. 8585-8595. 2021.
- Trevor Seets, Atul Ingle, Martin Laurenzis, and Andreas Velten. “Motion Adaptive Deblurring with Single-Photon Cameras.” In Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision, pp. 1945-1954. 2021.

2. Muhammad Ismail Khan (OSU): *Development of a Silicon-Carbide Neutron Detector*



Manfredotti et al. “SiC detectors for neutron monitoring” (2005).
Lutz, Gerhard. *Semiconductor Radiation Detectors: Device Physics* (1999).

X-ray radiation is effective at imaging inside the human body, but neutron radiation may be more effective for imaging fluids inside a metal engine. To use neutron radiation for imaging, a neutron sensor is required. The detection of radiation (whether charged particles, neutral particles, or photons) is a fundamental operation in applied science. Neutrons behave differently in matter than charged particles, and neutron detection is of particular interest in physics, nuclear engineering, and materials science.

The aim of my project is to develop a neutron detector module based on the silicon-carbide semiconductor material. This material has been historically of interest for neutron detection, and it offers the important advantages of radiation hardness and tolerance for high temperatures. Silicon carbide has a higher bandgap energy than silicon, which means that it takes greater energy to excite free electrons from the crystal lattice. This property makes a doped sample of silicon carbide less sensitive to high temperatures.

A semiconductor radiation detector consists of detecting devices as well as ancillary electronics, termed as readout electronics, that receive and process the signals from the detecting devices. A common detector is a diode with a voltage placed across it to produce an ionized region, termed as a depletion region. When radiation is incident on the diode, charge signals are produced in the depletion region. The readout electronics process the charge signal from each radiation event into a pulse with height representing the amount of charge. This allows for the rate of incident radiation to be measured.

ETI SUMMER SCHOOL: ADVANCED MANUFACTURING

Date: TBA (2022 or 2023)

ETI has hosted two successful summer schools. In 2020, ETI hosted a summer school on "Data Science and Engineering." In 2021, the summer school focused on "Novel Instrumentation and Sensors for Nuclear Fuel Cycle Monitoring." The 2020 and 2021 summer schools were offered online and had a cumulative student registration of over 300 students. The third ETI summer school will focus on "Advanced Manufacturing" and will be offered in either 2022 or 2023. Georgia Institute of Technology will host this summer school with the potential for regional national laboratory participation as well. ETI's goal is to offer the summer school in person.

This third ETI summer school will provide an introduction to advanced manufacturing. Initially students will learn about additive manufacturing, micro-manufacturing, and maker-communities. Hands-on learning will include student projects utilizing additive manufacturing technologies at the Flowers Invention Studio (Figure 1) (https://inventionstudio.gatech.edu/). Technologies available include a fleet of FDM and SLA printers, along with conventional advanced manufacturing technologies like CNC machining, laser cutters, and waterjet. Tours will introduce students to advanced metal-based additive manufacturing technologies located at the Advanced Manufacturing Pilot Facility (https://research.gatech.edu/manufacturing/ampf). Discussions will cover how advanced manufacturing may be utilized within the nuclear fuel cycle. In addition to learning the fundamentals of the technologies, summer school modules will also cover physical signatures, digital and electronic signatures, and side channel signatures from advanced manufacturing.

Work is underway for the ETI Summer School on Advanced Manufacturing. If you would like to get involved, please contact Professors Pavel Tsvetkov (tsvetkov@tamu.edu) and Steven Biegalski (steven.biegalski@me.gatech.edu).

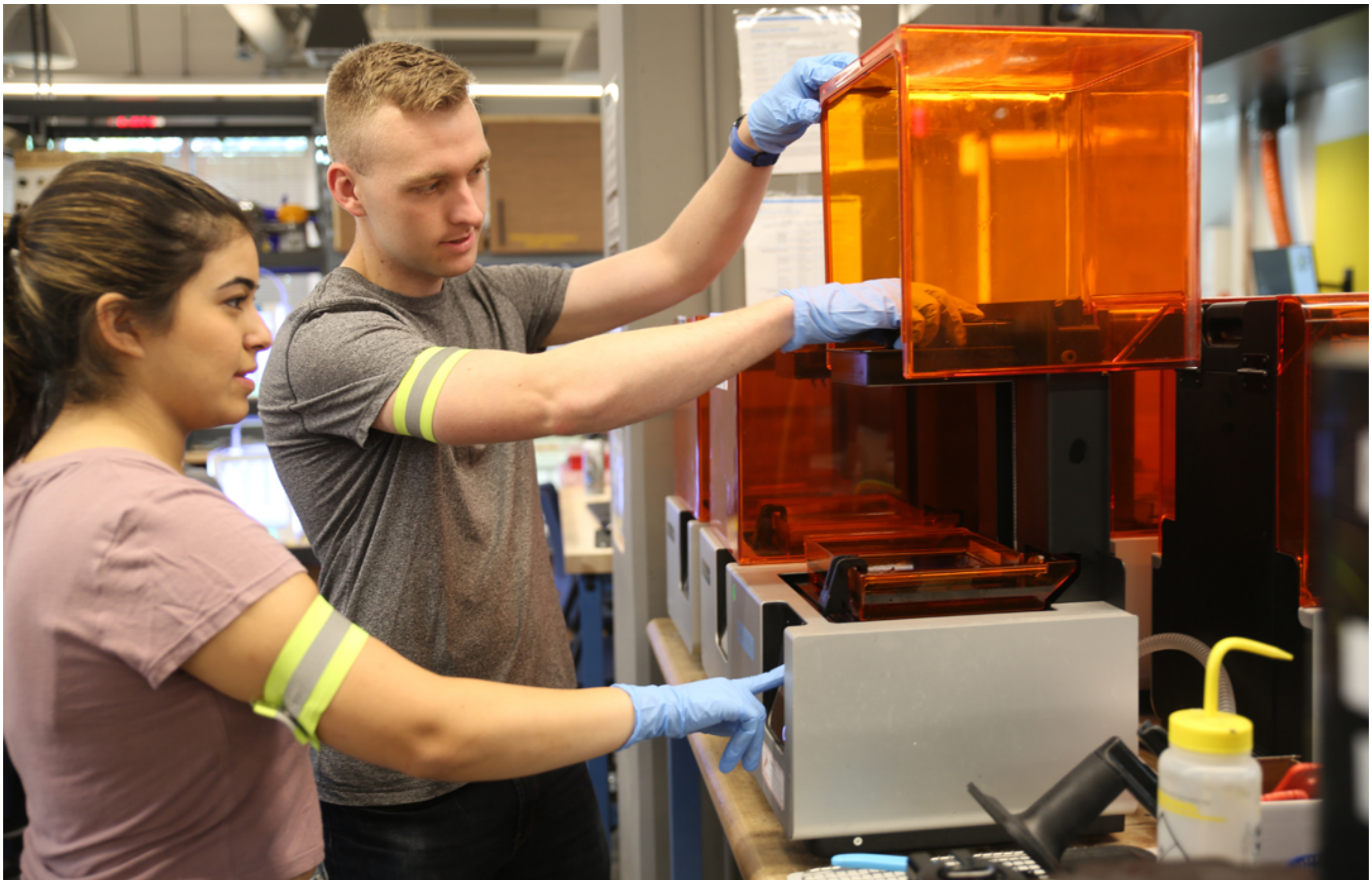


Figure 1. Formlabs printers in Flowers Invention Studio.

ETI Achievements *by the Numbers*

3
Students Receiving B.Sc. Equivalent Degree

9
Students Receiving M.Sc. Equivalent Degree

7
Students Receiving Ph.D. Equivalent Degree

5
Students Accepting a Job in the Field

12
Internships

2
Postdocs Transitioning to National Labs

17
Peer-Reviewed Publications Accepted

2
Book Chapters Accepted

2
Other Publication Accepted

41
Oral Presentations by Students

2
Oral Presentation by Postdocs

33
Oral Presentations by Professors/Faculty

22
Poster Presentations by Students

1
Poster Presentation by Faculty

15
Conference Papers/Reports

7
Keynote Speaker/Invited Talks

9
Outreach Programs

22
Courses Designed by ETI

AWARDS & HONORS

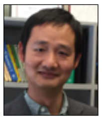
for ETI Faculty Members/Students

Ankur Agarwal received the Turnbull Award for Best Research Paper, Materials Science and Engineering Department New Graduate Student Orientation and Graduate Student Awards, August 2020.

Steve Biegalski has been named interim chair of the George W. Woodruff School of Mechanical Engineering, effective September 16. Biegalski is currently the chair of the Nuclear and Radiological Engineering and Medical Physics (NRE/MP) program at Georgia Tech, a position he has held since 2017. NRE/MP is housed within the Woodruff School.

Brian Clowers was named the Boeing Distinguished Professor of STEM Education for the College of Arts and Sciences at Washington State University.

Anna Erickson was awarded the American Nuclear Society Isotopes and Radiation Division's 2021 Radiation Science & Technology Award.



Jinsong Huang was named 2020 Highly Cited Researchers in Materials and Chemistry, Clarivate™ Web of Science.

Jonathan Rogers was named by the American Institute of Aeronautics and Astronautics an AIAA Associate Fellow, December 2020.

Dan Thoma received an Honorary Membership from The American Institute of Metallurgical and Petroleum Engineers, March 2021.

Neil Taylor, a newly graduated PhD student at The Ohio State University Nuclear Engineering Program, has started his new job at Oak Ridge National Laboratory as a full-time R&D associate in the Isotope Applications Research Group. Neil graduated as an ETI fellow for his year of PhD study in May 2021 and has started working at ORNL on July 12, 2021. Neil has been working on the ETI project with Dr. Raymond Cao as his advisor and in collaboration with Dr. Pooran Joshi at Oak Ridge.

Neil's research is focused on the fabrication of wide band gap radiation sensors based on 3-D printed metal contacts which has been very productive. Neil published a total 5 journal papers as 1st author and 3 as a co-author. He has also authored and co-authored several conference proceedings and national lab technical memos. Neil's new position at ORNL will be working on the electrodeposition and 3-D printing of isotopes and heavy element targets. He plans to continue working on the fabrication and implementation of sensors using additive manufacturing techniques, as well as the investigation into radioactive power systems.

SCHOLARSHIP RECIPIENTS SPOTLIGHT

Graduate Fellowship Recipients

Sarah Mantell

Sarah Mantell graduated summa cum laude with a Bachelor of Science in Mathematics from California Polytechnic State University, San Luis Obispo in June 2021. Prior to graduation, Sarah was also a recipient of the ETI Undergraduate Scholarship. In fall 2021, she will begin a Ph.D. program at the University of California, Santa Barbara in applied mathematics while continuing her work at Los Alamos National Laboratory.

Research and Academic Interests:
Sarah's research interests are widespread and include machine learning, image processing, and cryptography. At Los Alamos National Laboratory, she is involved in an interdisciplinary additive manufacturing project that aims to characterize the material properties of final parts based on the build parameters used. Currently Sarah is developing computer vision algorithms to automatically characterize melt pool geometry. Outside of mathematics, she is interested in photography, cross stitching, and cooking. Her current cross-stitch project is Evening by Leonid Afremov and requires over 235,000 stitches.

**Sarah also received an undergraduate scholarship prior to her graduation from California Polytechnic State University, San Luis Obispo.*

Alexandra (Lexie) Schueller

Alexandra (Lexie) Schueller is a third-year graduate student at the Georgia Institute of Technology studying mechanical engineering. Previously, she graduated from The University of Texas at Austin with a B.S. in mechanical engineering and a certificate in manufacturing and design. She also has past experience working at 3M, General Electric, and IBM on measurement system design, thermal systems design, design for manufacturing, and manufacturing process optimization. In her free time, she enjoys waterskiing, alpine skiing, and playing volleyball.

Research and Academic Interests:
Lexie recently finished her master's degree at Georgia Tech as a part of the Enhanced Preparation for Intelligent Cybermanufacturing Systems (EPICS) research group. Her research focused on in-situ machine tool condition monitoring and IoT sensor development using indirect process signals and ensemble machine learning techniques. For her Ph.D. work, she plans to combine her interests in artificial intelligence, additive and hybrid manufacturing, and IoT to promote advancements in real-time production monitoring, efficiency optimization, and smart factory technology.

SCHOLARSHIP RECIPIENTS SPOTLIGHT

Undergraduate Scholarship Recipients

Jordan Parker-Ashe

Jordan Parker-Ashe is a Massachusetts Institute of Technology freshman from Virginia Beach, VA. She is considering majoring in nuclear engineering, and then hopes to continue on to medical school. Jordan is an ocean rescue lifeguard and an EMT, volunteering with MIT EMS. In her spare time, she loves to surf, hike, read, play piano, stargaze with her telescope, and play with her two German Shepherds. She would like to give a big thank-you to Professor Short, Rachel, Nouf, and everyone else who believed in her and supported her on this journey. She started by watching YouTube tours of MIT's nuclear facilities, and now she has her own desk there.

Research and Academic Interests:
Jordan is an undergraduate researcher in Professor Michael Short's lab, the MIT Mesoscale Nuclear Materials Group. She is deeply passionate about nonproliferation, nuclear forensics, and the peaceful use of nuclear materials for sustainable power generation. In the context of nuclear archeology, she is currently studying the morphological properties of irradiated carbon fiber using several microscopy and DSC techniques, gearing up to write her very first paper for publication!

Nick Folino

Nick is a senior getting his B.S. in Computer Engineering at The Ohio State University. Nick is originally from Painesville, Ohio, which is just east of Cleveland. He has a passion for hardware and software technologies, which is the reason he chose the major. In his free time Nick loves to watch movies, cook, play video games, and play basketball.

Research and Academic Interests:
Nick is currently doing research for OSU's Nuclear Engineering Department where he is tasked with designing and building a radiation detector out of a field-programmable gate array (FPGA) device. The end goal of the research is to set the groundwork for future nuclear engineering coursework that teaches students about instrumentation that utilizes digital signal processing and analog-to-digital conversion to retrieve radiation data.

Alexander Greenhalgh

Alex is currently an undergraduate material science and engineering major with a minor in mathematics at the University of Tennessee, Knoxville. His hobbies include trail running and 3D printing. Alex has always had a fascination with computer science, so he wants to go into a field like computational science that combines his domain knowledge of materials with his interest in mathematics and coding.

Research and Academic Interests:
In Alex's undergraduate research and internships thus far, his work has involved scientific visualization and materials modeling. In the past, he designed and coded a statistical method to visualize the presence of atomic ordering in materials and run classical molecular dynamics simulations in order to obtain mechanical and thermodynamic properties of various crystalline solids. The satisfaction and skills he gained from these projects have helped him to realize his professional goals, which involve going to graduate school and seeking a Ph.D. in computational science. Because of his interest in additive manufacturing, Alex would love to conduct research using his existing skills in materials modeling to investigate the processing-structure-property-performance relationships of additively manufactured materials for nuclear applications.

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